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(72) Inventor ALFRED LONGWORTH

(19)

(54) IMPROVEMENTS IN OR RELATING TO FLUID MIXER DEVICES

(71) We, T. I. DOMESTIC APPLIANCES LIMITED, (formerly known as Radiation Limited), a British Company, of Radiation House, North Circular Road, London. NW10 0JP, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to fluid mixer devices and has particular reference to mixer devices for mixing gas and air to produce a combustible mixture for gaseous fuel burners.

It has been proposed to employ for such devices a construction comprising an open-ended tubular mixing chamber into which gas is introduced through apertures in the curved walls of the chamber in such manner that a swirling motion is created inside the chamber and air is aspirated into the chamber via one of the open ends thereof, the gaseous mixture leaving the chamber via the other open end. However, it is found that the jets of gas entering the chamber via the apertures tend to remain close to the curved wall of the chamber and this reduces the extent to which the gas and air mix.

It is an object of the present invention to provide a mixer device of improved deisgn.

According to the present invention a fluid mixer device comprises an open-ended cylindrical mixing chamber and means at or adjacent one end of the chamber for inspirating one of the fluids into the chamber, the means comprising a supply header for the other fluid, the header being of generally annular form and having a surface coaxial with the longitudial axis of the chamber and facing the other end of the mixing chamber, and a series of apertures in the surface and in communication with the interior of the header, the apertures being disposed inwardly with respect to the inner surface of the chamber and being so arranged that, in use, fluid entering the chamber from the apertures has imparted to it a helical motion about the longitudinal axis and directed towards the other end of the chamber, the arrangement being such that, in use, the one fluid is drawn into the chamber through the supply header and from outside the header into the chamber at points, adjacent the apertures, such that there is created a flow of the first fluid between the apertures and the inner surface of the chamber.

In one embodiment of the invention the supply header is positioned coaxially within the mixing chamber, the arrangement being such that there is formed an annular passageway between the header and the chamber for the entry into the latter of fluid between the apertures and the inner surface of the chamber.

In another embodiment, the supply header is received in the one end of the mixing chamber, the curved wall of the latter being gapped or formed with holes at locations close to the apertures to permit the entry into the chamber of fluid between the apertures and the inner surface of the chamber.

The header may comprise inner and outer tubular members nested together to form the annular header. At one end the members have surfaces which coact to provide the apertures in an end surface. Either inner or outer member may have a shoulder grooved on its outer or inner face respectively and which cooperates with a plain face on the other member to form the apertures.

A gaseous fuel burner incorporating a mixer device embodying the invention includes a burner head with an inlet adapted to receive the output of the mixer device and so arranged relatively thereto in such manner that further air is entrained in the output of the mixer device as that output enters the burner head inlet.

The burner may have several such inlets each fed from a separate mixer device.

By way of example only, embodiments of

the invention will now be described in greater detail with reference to the accompanying drawings of which:—

Fig. 1 is a plan view of a first embodiment,

Fig. 2 is a section on the line II—II of Fig. 1,

Fig. 3 is a plan view of a component of the embodiment shown in Fig. 1,

Fig. 4 is a section on the line IV—IV of Fig. 3,

Fig. 5 is a plan view of a second embodiment,

Fig. 6 is a section on the line VI—VI of Fig. 5,

Fig. 7 is a plan view of an alternative form of one of the components of the mixer,

Fig. 8 is a section on the line VIII—VIII of Fig. 7, and,

Figs. 9 and 10 are side elevations of a gaseous fuel burner incorporating a mixing device embodying the invention.

The embodiment shown in Figs. 1—4 comprises an outer open-ended sleeve 1 within which is coaxially positioned an assembly 2 comprising inner and outer members 3, 4 nested to form an internal annular space 5 access to which is provided by a radial extension 6 of the outer member 4. Secured, for example by screwing, to the extension 6 is a connector 7 which passes through an aperture in the wall of the sleeve 1 so enabling the assembly 2 to be attached to and located within the sleeve 1, the assembly being spaced from the sleeve by an annular gap 8.

The outer member 4 has a flange 9 at one end, the inner face 10 of the flange being formed to provide a series of grooves 11 that are inclined with respect to the axis of the member 4 by an angle lying within the range 35°—60° and preferably about 45°. The other end of member 4 is contoured to fit closely the slightly-belled end of the inner member 3. The other end of the member 3 is sized to fit tightly against the face 10 of the flange 9. As can be seen from Fig. 2, the axial lengths of the members 3 and 4 are equal so that with the members in the positions shown in Fig. 2, a series of apertures is formed in the end surface of the assembly 2 uppermost in Fig. 2.

The device shown in Figs. 1—4 is intended to mix air and gas and the connector 7 is joined to a source of gas. In use, gas emerges from the apertures as a series of jets which, because of the inclination of the grooves 11, establish a vortex within the sleeve 1. The axis of the vortex coincides substantially with that of the assembly 2 and the region of low pressure within the vortex around that axis causes air to be drawn in through the inner member 3. The slightly converging internal configuration of the member 3 produces an increase in the velocity of the air so drawn in and this helps to maintain the generally upward movement of the air-gas flow.

In addition, air is drawn in through the annular passageway 8 and enters the chamber between the apertures and the inner surface of chamber 1. Thus the jets of gas are in intimate contact with a central core of air entering via the inner member 3 and an outer sheath of air entering via the passageway 8. In this way a large volume of air is drawn into the upper part of the sleeve 1 and mixed effectively with the streams of gas.

In the embodiment shown in Figs. 5 and 6, there is included a sleeve 12 having a bore with a portion 13 of constant internal diameter and a second portion 14 whose bore diverges with increasing distance from portion 13. The lower (as seen in Fig. 6) end of the sleeve is stepped to receive one end of an assembly, similar to assembly 2 described above except that the outer member 4 is stepped at 15 to mate with the correspondingly contoured end of the sleeve 12.

The lower end of the sleeve 12 is also castellated, the gaps of the castellations being indicated at 16. Alternatively, the sleeve may be formed with a series of apertures of "windows" disposed circumferentially adjacent its lower end.

When the components are assembled as shown in Fig. 6, the gaps 16 of the castellations or the windows are so located that they lie adjacent the apertures formed in the end wall of the assembly 2 uppermost in Fig. 6.

The embodiment shown in Figs. 5 and 6 operates in a manner generally similar to the embodiment of Figs. 1—4. Extension 6 is joined to a source of gas, and gas emerges from the apertures as a series of jets to establish a vortex within the sleeve 12. Air is drawn in through the inner member 3 by the low pressure zone within the vortex to provide the inner core of air described above and also through the gaps 16 to provide an outer sheath of air between the apertures and the inner surface of the chamber.

It is not essential that the grooves 11 be formed in the outer member 4. The grooves could, alternatively, be formed in the inner member 3 and Figs. 7 and 8 show an alternative form of inner member.

As is shown in Figs. 7 and 8, the upper (as seen in the Figs.) end of inner member 17 has an outwardly extending shoulder 18 grooves at intervals round its periphery as indicated at 19. The grooves are inclined at an angle lying within the range 35°—60° preferably about 45° to the axis of the member 3. The outer member co-operating with an inner member of the form shown in Figs. 7 and 8 incorporates a flange similar to

flange 9 described above but which has a plain inner face that is not grooved as is the face 10 of the flange 9.

An assembly with an inner member of the form shown in Figs. 7 and 8 can be used in the embodiments of Figs. 1—4 and Figs. 5 and 6 instead of the assembly 2.

The inner and outer members of the assemblies described above may be, for example, die cast in aluminium, the grooves being subsequently accurately sized by a suitable machining operation. Alternatively, after the members are put together the grooves can be sized by a swaging, the size being measured by passing air through the assembly. For example, a ball-ended tool is forced into the bore of the inner member 2 compressing the entrance thereof to an extent necessary to ensure the correct groove depth as determined by the air flow measurement.

Whilst the mixing devices described above can be used to mix any fluids, the devices are primarily intended to form mixing devices for incorporation in gaseous fuel burners, the fluids then being gas and air as described above. The device may be fitted to a burner head which seats directly on the upper (as seen in the drawings) end of the sleeves 1 or 12 or alternatively the burner head may have an entrance adapted to receive the mixed gas-air output of the mixer device and to permit the ingress of an additional supply of air drawn from the atmosphere. Such a construction is shown diagrammatically in Fig. 9.

The burner head is of the construction described in the Specification of co-pending Patent Application No. 17691/72 serial No. 1 443 413 that is it includes a diffuser positioned in the mouth of the burner head, the diffuser having a path therethrough for the circulation of a cooling fluid. The burner may form part of a water heater as described in the specification here mentioned.

Fig. 9 shows such an arrangement in diagrammatic form. A burner head 20 has a belled entrance 21. Located centrally with respect to the entrance 21 is a mixing device 22 which may be of either of the forms described above. Positioned in the mouth of the burner head 20 is a diffuser comprising a plurality of finned water pipes indicated in Fig. 9 by block 23. The device 22 operates in the manner described above, the mixture of gas and air issuing from the upper (as seen in Fig. 9) end of the device passing into the entrance 21, entraining as it does so a further supply of air as indicated by the arrows in Fig. 9.

For burners of greater thermal output, it may be necessary to employ two or more mixer devices and Fig. 10 shows a burner employing two mixer devices 23, 24 supplying a common burner head 25.

WHAT WE CLAIM IS:—

1. A mixer device for mixing first and second fluids comprising an open-ended cylindrical mixing chamber and means at or adjacent one end of the chamber for inspirating a first fluid into the chamber, the means including a supply header for the second fluid, the header being of generally annular form and having a surface co-axial with the longitudinal axis of the chamber and facing the other end of the chamber, and a series of apertures in the surface and in communication with the interior of the header, the apertures being disposed inwardly with respect to the inner surface of the chamber and being so arranged that, in use, second fluid entering the chamber from the apertures has imparted to it a helical motion about the longitudinal axis and directed towards the other end of the chamber, the arrangement of the device being such that, in use, the first of the device being such that, in use, the first fluid is inspirated into the chamber through the supply header and from outside the header into the chamber or points, adjacent the apertures, such that there is created a flow of the first fluid between the apertures and the inner surface of the chamber.

2. A mixer device as claimed in claim 1 in which the supply header is positioned co-axially within the chamber in such manner that there is an annular passageway between the header and the chamber for the entry into the latter of first fluid between the apertures and the inner surface of the chamber.

3. A mixer device as claimed in claim 1 in which the supply header is located at the one end of the mixing chamber and in which the mixing chamber is gapped or formed with holes at locations close to the apertures to permit entry into the chamber of first fluid between the apertures and the inner surface of the chamber.

4. A mixer device as claimed in claim 1, 2 or 3 in which the header comprises inner and outer tubular members nested together, the members having surfaces that co-act together to form the apertures.

5. A mixer device as claimed in claim 4 in which one of the members has a grooved shoulder that co-acts with a plane surface on the other member to form the apertures.

6. A mixer as claimed in claim 5 in which the grooves are linear and lie along lines inclined to the axis of the mixing chamber

7. A mixer device as claimed in claim 6 in which the inclination is such that the angle between the grooves and the axis lies in the range of from 35°—60°.

8. A mixer device as claimed in claim 7 in which the angle is 45°.

9. A gaseous fuel burner comprising a burner head with an inlet and a mixer device as claimed in any one of the preceding claims for mixing a gaseous fuel and air for supply as a combustible gaseous fuel mixture to the burner inlet.

10. A gaseous fuel burner as claimed in claim 9 having a plurality of gaseous fuel mixture inlets each supplied, in use, with gaseous fuel mixture from a different mixer device.

11. A gaseous fuel burner as claimed in claim 9 or 10 in which the or each mixer device is separated from the respective gaseous fuel inlet of the burner by an air gap for permitting the entrainment of air into the gaseous fuel.

12. A gaseous fuel burner as claimed in any one of claims 9, 10 or 11 in which the or each gaseous fuel mixture inlet is of belled form.

13. A gaseous fuel burner as claimed in any one of claims 9 to 12 in which there is located in the mouth of the burner head a gaseous fuel mixture diffuser having a path therethrough for the passage of a cooling fluid.

14. A gaseous fuel burner as claimed in claim 13 in which the gaseous fuel mixture diffuser comprises a plurality of finned pipes.

15. A water heater comprising a gaseous fuel burner as claimed in claim 14 in which the finned pipes form part of a path for circulating water to be heated.

16. A mixer device substantially as herein described with reference to and as illustrated by Figs. 1—8 of the accompanying drawings.

17. A gaseous fuel burner substantially as herein described with reference to and as illustrated by Fig. 9 or Fig. 10 of the accompanying drawings.

ABEL & IMRAY,
Chartered Patent Agents,
Northumberland House,
303—306 High Holborn,
London, WC1V 7LH.

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1469097 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

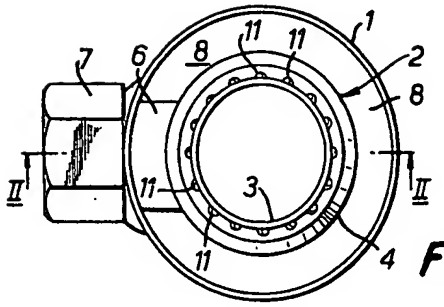

FIG. 1.

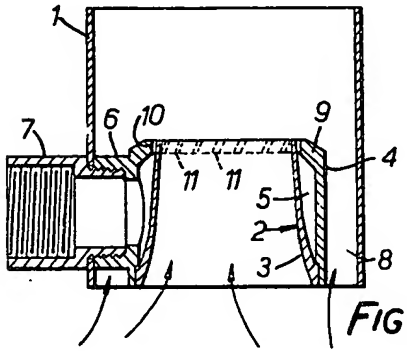

FIG. 2.

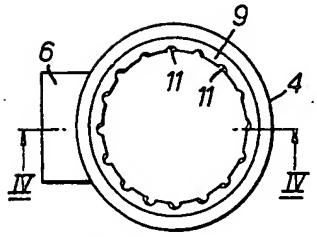

FIG. 3.

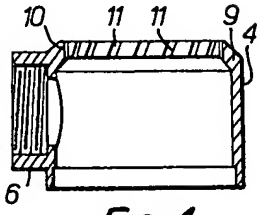

FIG. 4.

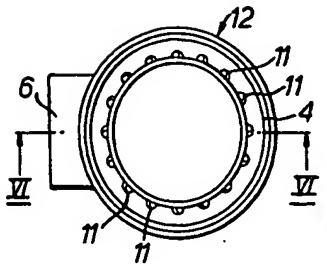

FIG.5.

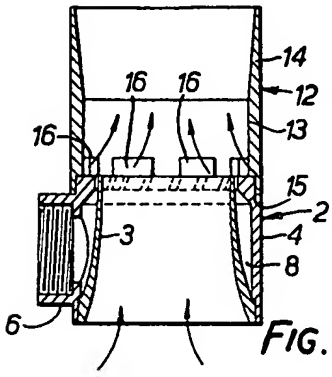

FIG.6.

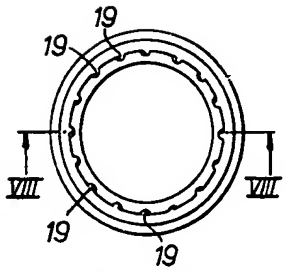

FIG.7.

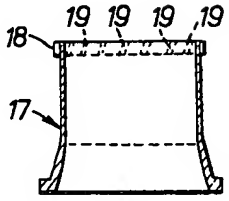

FIG. 8.

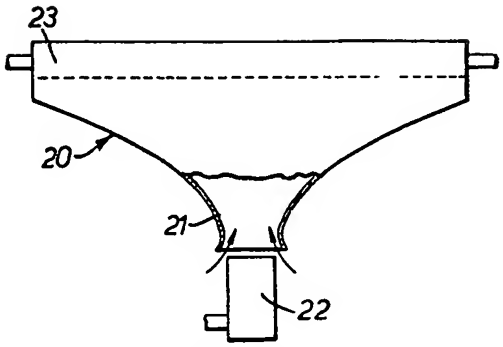

FIG. 9.

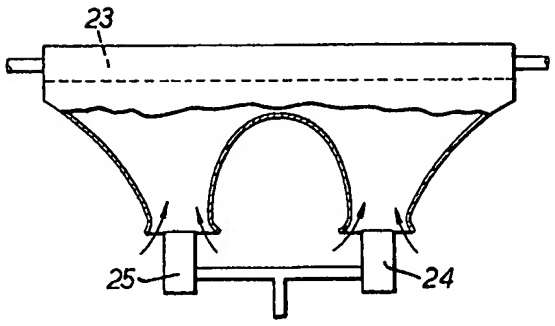

FIG. 10.